The Galactic Gamble

SETI Researchers Boldly Comb the Cosmos for Steller Radio Stations . . .

By Michael Mechanic

It was 3 a.m. in Green Bank, West Virginia, when Frank Drake's alarm clock sounded, but the 29 year-old radio astronomer had no trouble waking. Drake and two student assistants at the National Radio Astronomy Observatory —a facility then under construction— were about to make history. The date was April 8, 1960, and the team was going to take humankind's first-ever crack at interstellar communication. For the first time, human beings would turn an ear to the cosmos in an attempt to intercept radio signals transmitted from far-off planetary systems by intelligent, though probably quite non-human beings.

Dubbed "Ozma," after a princess from L. Frank Baum's fictitious land of Oz, the experiment relied on the observatory's recently completed 85-foot diameter radio telescope. The scope's receiving device was located in a cylinder at the reflector's focal point, more than five stories off the ground. Before proceeding on that cold morning, Drake had to spend nearly an hour tuning an amplifier inside this "glorified garbage can." By 5 a.m. he was back in the control room, ready to listen. It was a verifiable radio signal he sought—one that would stand out from the cosmic background noise in a distinctly artificial way. Drake's search would, in time, unite some of the world's leading scientific minds, escort the emerging field of radio astronomy into prominence, engage NASA, Congress and roughly $75 million in private and federal funds, and, ultimately make a legitimate scientific pursuit of one of the most profound questions in human history: Are we alone in the universe?

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Today, more than 36 years later, despite exponential leaps in technology and numerous cosmic eavesdropping projects worldwide, the listeners have cov-

The National Science Foundation's 1000-foot diameter radio telescope near Arecibo, Puerto Rico listens to tiny segments of the universe for signals from advanced civilizations.

If there's an abundance of life in the cosmos, could it be in one of these distant galaxies photographed by the Hubble Space Telescope?

ered only the tiniest fraction of our galaxy. "You can't even say we haven't scratched the surface, because it's too weak an analogy," says Dr. Jill Tarter, who searched for alien signals with renowned UC Berkeley astronomer Stuart Bowyer and is a top scientist at the SETI Institute (Search for Extraterrestrial Intelligence) in Mountain View. "If you want to enumerate it, which we used to do very assiduously, [we've covered] one part in 10^{12}, one part in 10^{10} maybe."

Drake, now 66, is a professor of astronomy at UC Santa Cruz and president of the SETI Institute, but in 1958, he was among the first few Harvard students to have earned a doctorate in the emerging field of radio astronomy. When a visiting lecturer named Otto Struve presented evidence for the existence of distant planets and suggested that life could exist elsewhere within our galaxy, Drake was inspired. Might some of these alien creatures be intelligent or even technologically capable? Drake and others have bet their careers and a lot of private and federal dollars on this hunch.

The Quiet Zone

For Ozma, Drake chose a radio frequency near 1420 MHz—that of the hydrogen atom. Because hydrogen is the most abundant element in the cosmos, Drake reasoned that intelligent civilizations might recognize 1420 as special. It also falls into the cosmic "quiet zone"—a portion of the spectrum relatively free of interference from natural celestial sources and artificial terrestrial ones. Set to receive on that morning in 1960, Drake pointed the Green Bank telescope toward nearby star *Tau Ceti*. The team waited in anticipation. And waited. They waited uneventfully until noon, when their target plunged below the horizon. They moved the telescope towards *Epsilon Eridani* and resumed their wait. Minutes later, loud squawks burst from the speaker and chart recorder flew crazily off scale with pulses coming in at eight times a second. Barely able to contain his excitement, Drake aimed the telescope away from the star, then moved it back to see if the signal returned. It didn't.

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Ten days later, the signal appeared again, long enough for the scientists to determine its origin: Earth. Only much later did a military source confirm that the signal was a military jamming device.

We're Listening, Is Anyone There?

By the early 1980s, some 42 searches had been conducted worldwide, three by Drake and colleagues, and others by the likes of Stuart Bowyer at Berkeley and Paul Horowitz at Harvard. NASA entered the game, circa 1971, hosting a summer-long brainstorming session of SETI experts that was dubbed "Cyclops." The resulting "Cyclops Report" inspired many scientists, including Bowyer and Tarter to embark on their own SETI projects, and NASA began including SETI into its budget on a regular basis.

Despite the excitement, SETI fielded much criticism from skeptical scientists and politicians. "I finally changed my mind after hearing some good arguments on the, 'They're not there' side," says UCLA Radio Astronomer Ben Zuckerman, who early in his career searched 600 stars in an unsuccessful follow-up to the Ozma experiments. Zuckerman was swayed by "the Fermi Paradox," an argu-

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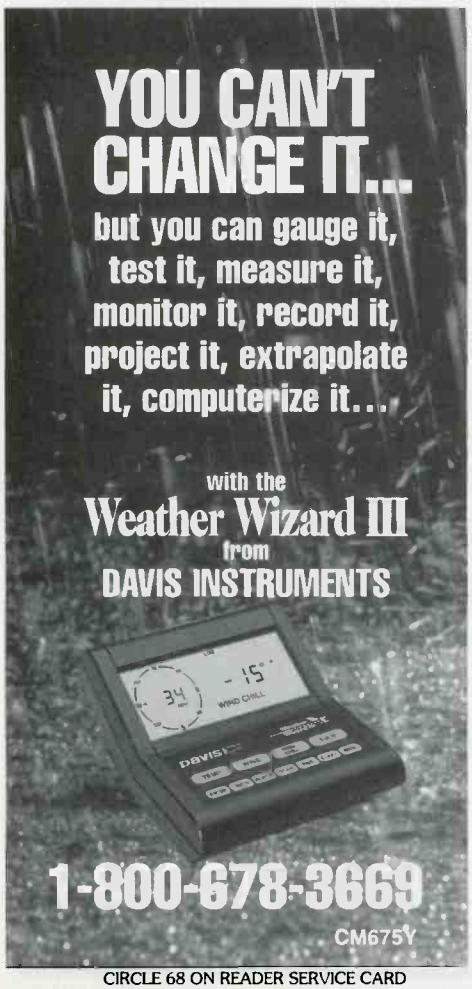
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ment raised by Nobel physicist Enrico Fermi: If advanced civilizations are out there, we should have already seen them. This idea was later developed by Trinity College Physicist Michael Hart, who constructed computer models of developing solar systems that suggested conditions so harsh as to make the presence of life-sustaining planets like Earth a fluke. But the SETI community's prospects have been bolstered considerably by recent discoveries of new planets by several teams, most notably UC Berkeley's Geoffrey Marcy and Paul Butler, and by recent evidence pointing to possible microbial life on Mars. "[Some scientists] may think we're the only intelligent life in the universe, but we're talking 10^{22} stars, so I find that theory com- pletely preposterous," says Harvard's Paul Horowitz, who has built some of the world's most powerful SETI receivers. "If in 100 years we haven't found anything, then I'll be a hell of a lot more pessimistic." Tarter concurs. "Our chances of success are zero if we don't do it and greater than zero if we do, and that's a big distinction," she says. "I mean, you don't spend your life doing something you know can't work."

After coming under political attack in the early 1990s, the SETI Institute and smaller searches, like Bowyer's "SERENDIP" projects, were dumped from the NASA budget. Although the smaller projects have struggled to stay afloat, the SETI Institute's latest effort, Project Phoenix, has attracted more than $7.3 million in private donations. From February through June of 1995, Phoenix researchers took up residence at the Parkes radio astronomy observatory in New South Wales, Australia. Using the facility's 64-meter radio telescope, they listened to about 200 southern hemisphere stars—some of the 1000 originally slated for attention—at frequencies from 1200– 3000 MHz. The new equipment scanned 28 million channels simultaneously at single-Hertz resolution, and, for the first time, researchers had a follow-up telescope, located 120 miles away, allowing them to distinguish immediately between terrestrial and potential extraterrestrial signals by the presence or absence of Doppler shift.

The extraterrestrials remained elusive, however. Promising signals turned out to be satellites, military radar and TV stations. "It's disappointing, but it doesn't discourage us. The equipment all worked pretty well and that was a technical triumph," says SETI scientist Seth Shostack. "You never give up. If you look at 1000 stars and don't find anything, can you conclude we're alone? No you can't."

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Phoenix's now plans to focus on 900 northern hemisphere stars, all within 150 light years of Earth. Drake naturally believes federal funding of SETI research serves the public interest. He notes that NASA has spent between $60 million and $70 million on SETI since 1971. "That's less than the cost of one fighter plane, but the potential payoff for Earth is much greater," says the astronomer. "It's a high-stakes gamble where the payoff is enormously large and, if you succeed, the benefit per dollar spent will be greater than for any project in history." That payoff, Drake says, includes knowledge of technology of other worlds, learning whether space colonization is practical and how it might be done, and whether nuclear fusion is feasible as a clean energy source. "We will learn just what the limits of growth and the quality of life are for other civilizations and this will give us great guidance in planning for our own world," Drake says.

Some scientists question the wisdom of communicating with technologically superior, potentially hostile beings. But most SETI researchers consider the chance of direct contact to be infinitesimally small. "Our existing spacecraft, at the maximum speed they go, would take about 100,000 years to go to the nearest star, and this is not a feasible travel time for a colony or a mini-planet or anything else," Drake says. "At the speeds you must travel, a small pebble striking you releases as much energy as a hydrogen bomb, and that's going to be the end of your mission."

"Travel would be boring and expensive," concurs Horowitz. "Energetically, it's just a stupid thing to do."

But some avid SETI proponents, like Shostak and Carl Sagan, never ruled out the many possibilities. We simply don't yet know enough about what is or isn't possible in the universe, they say. All we can do is go about our small terrestrial lives, make our scientific discoveries in time, and, every so often, on quiet star-filled nights, turn our ears to the heavens, and listen patiently. ■